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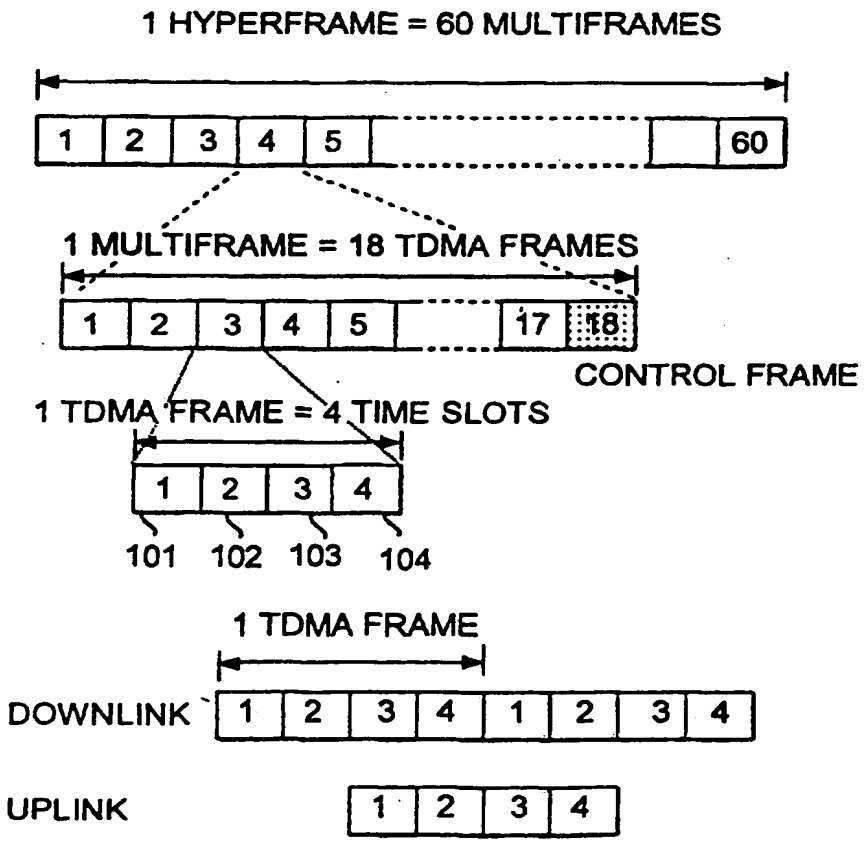
(54) Title: ALLOCATION OF TIME SLOTS IN A MOBILE COMMUNICATION SYSTEM

(57) Abstract

A method for allocating time slots (101-104) in a mobile communication system comprising a base station (300) and mobile stations (MS), said base station communicating with said mobile stations on a radio frequency divided into TDMA frames (1-18), which are further divided into time slots (101-104), of which at least one (101, 103, 104) can be allocated as a traffic channel of one or more mobile stations. The method comprises the steps of transmitting information from the base station (300) to a mobile station (MS) on the allocation of a time slot other than a traffic time slot (101, 103, 104) used by the mobile station as a signalling time slot (102) common to the mobile stations (MS) communicating on said radio frequency, starting to use said time slot (102) as a signalling time slot common to the mobile stations (MS) communicating on said radio frequency in the signalling traffic between said base station (300) and said mobile stations in such a manner that the mobile stations can also communicate in one or more traffic time slots.



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Allocation of time slots in a mobile communication system

Field of the invention

The invention relates to a method for allocating time slots in a mobile communication system comprising a base station and mobile stations, said base station communicating with said mobile stations on a radio frequency divided into TDMA frames, which are further divided into time slots, of which at least one can be allocated as a traffic channel of one or more mobile stations.

Background of the invention

The invention relates to the field of trunked mobile telephone systems. A trunked system is a radio network which by means of shared use of radio channels offers the services of a company-specific radio network to several organizations. Trunked systems comprise control exchanges, base stations and mobile telephones. Trunked systems typically have a cellular structure, whereby each cell has one or more radio channels which are further divided into time slots, of which one or more are used as signalling channels, while the others are used as traffic channels. The signalling channels are used for call establishment, registrations, etc. The traffic channels are used for transmitting speech and for circuit mode data connections.

The invention is suitable for use particularly in mobile telephone systems with a digital radio path. One digital mobile telephone system is described in standard ETS 300 392-2:1994, Radio Equipment and Systems (RES); Trans-European Trunked Radio (TETRA); Voice plus Data (V+D), Part 2: Air interface, ETSI, 625 pages.

The invention is intended to be applied par-

ticularly to PMR mobile telephone or mobile communication systems (PMR = Private Mobile Radio). PMR systems are typically used by companies or authority organizations. Mobile telephone systems can be based, for example, on FDMA or TDMA technology. The invention is intended to be applied especially in TDMA systems (TDMA = Time Division Multiple Access).

When channels are allocated between base stations and subscriber stations, there are typically a limited number of channels available, since there are only a small number of radio frequencies and/or time slots. In modern mobile communication systems it is often important to allow a mobile station to have a signalling connection (Control Channel) with the base station at the same time that the mobile station in question has a telecommunication connection, i.e. speech or data connection, with the base station. The signalling connection is needed, for instance, for transmitting to the mobile station information on other, beginning or ongoing calls, short data messages or status messages. There are prior art solutions in which a radio unit involved in a call has at suitable intervals moved for short periods to other frequencies to listen to them, i.e. monitored or scanned the desired adjacent channels. However, such a solution does not enable reliable reception of short data messages and status messages at a mobile station. Furthermore, switching the receiver of a radio unit to another frequency, i.e. scanning, requires guard times, during which the radio unit cannot be used for communication.

In FDMA systems (FDMA = Frequency Division Multiple Access), the possibility of transmitting signalling messages or other kinds of data during calls or data calls is called in-band signalling. In this system, part of the transmission capacity of a channel

is typically used during a call for signalling, which displaces the actual speech or circuit mode data.

In addition, it is known to fixedly reserve part of the traffic capacity allocated to one user for signalling. This is called out-band (channel-associated) signalling.

The problem with the prior art solutions is that the control channel capacity according to the protocol of the prior art TETRA mobile telephone system is extremely limited during speech items in individual and group calls. During a speech item, only a slow control channel is available once a second. Certain services and particularly implementations intended for PMR networks used by authorities require higher signalling capacity during speech items.

Description of the invention

The object of the present invention is to provide a method by means of which a mobile station in a TDMA mobile communication system can transmit and receive signalling messages at the same time that it participates in a call with the base station of the mobile communication system. The object is thus to render it possible for a mobile station, while participating in a first call, to receive information e.g. on what other calls it might participate in. It is a further object of the invention to allow the mobile station, while participating in a call, to receive short data messages and status messages.

It is a specific object of the invention to provide a method and a system by means of which a mobile station, while participating in a call in a traffic channel time slot of a frame in a TDMA system, can receive and transmit signalling messages.

This new type of method for allocating time

slots is achieved with a method of the invention, which is characterized in that the method comprises the steps of transmitting information from the base station to a mobile station on the allocation of a time slot other than a traffic time slot used by the mobile station as a signalling time slot common to the mobile stations communicating on said radio frequency, starting to use said time slot as a signalling time slot common to the mobile stations communicating on said radio frequency in the signalling traffic between said base station (300) and said mobile stations in such a manner that the mobile stations can also communicate in one or more traffic time slots.

The invention further relates to a mobile communication system comprising: mobile stations, a base station communicating with said mobile stations on a radio frequency divided into TDMA frames, which are further divided into time slots, of which at least one can be allocated as a traffic channel of one or more mobile stations, said base station comprising: an antenna, a transceiver, a control unit, and means for signalling with the mobile stations.

The mobile communication system of the invention is characterized in that the base station further comprises means for transmitting to the mobile stations communicating with the base station information on the allocation of a time slot other than a traffic time slot in said TDMA frame as a signalling time slot common to mobile stations communicating on said radio frequency, in response to which information said mobile stations communicating on said radio frequency start to use said time slot as their common signalling time slot in the signalling traffic between said base station and said mobile stations in such a way that said mobile stations can also communicate in one or more traffic time slots.

The invention further relates to a mobile station comprising: a transceiver communicating with said mobile stations on a radio frequency divided into TDMA frames, which are further divided into time slots, of which at least one can be allocated as a traffic channel of one or more mobile stations.

The mobile station of the invention is characterized in that the mobile station comprises: means responsive to information on the allocation of a time slot other than a traffic time slot in said TDMA frame as a signalling time slot common to the mobile stations communicating on said radio frequency for commanding said mobile station to use said time slot with other mobile stations as a common signalling time slot in the signalling traffic between said base station and the mobile stations in such a manner that said mobile stations can also communicate in one or more traffic time slots of said frame.

The invention also relates to a mobile station comprising: a transceiver communicating with the base station of the mobile communication system on a radio frequency divided into TDMA frames, which are further divided into time slots, of which at least one can be allocated as a traffic channel of one or more mobile stations, said mobile station being capable of communicating with the base station in only one time slot of the frame. In this case, the mobile station of the invention is characterized in that, in response to information on the allocation of a time slot other than a traffic time slot in said TDMA frame as a signalling time slot common to mobile stations communicating on said radio frequency, the mobile station is arranged to communicate only in one or more traffic time slots of said frames.

The invention is based on the idea that

information on the control, or signalling, channel and traffic channel to be allocated to a radio unit, typically a mobile station, is sent from the base station to the mobile station sufficiently accurately in one message. The mobile station can then communicate in one TDMA frame both on the signalling channel and on the traffic channel. According to the invention, the mobile station can thus both participate in a continuous telecommunication connection, e.g. a call, and receive and transmit signalling messages on the signalling channel.

An advantage of such a method for allocating time slots in a mobile communication system is that it solves the problem associated with the prior art: it allows a mobile station to start communication rapidly in a certain frame both in a traffic time slot and in a signalling time slot.

A further advantage of the invention is that it also allows a common in-call signalling time slot to be allocated only when necessary, i.e. when additional signalling capacity is of real use to the users. The invention thus enhances the flexibility of communication between the base station and a mobile station.

Brief description of the drawings

In the following, the invention will be described in greater detail with reference to the accompanying drawings, in which

Figure 1 shows the frame format in a TETRA radio telephone system,

Figure 2A shows a channel allocation message according to an embodiment of the invention to be sent to a mobile station,

Figure 2B shows a channel allocation message according to another embodiment of the invention to be

sent to a mobile station,

Figure 3 shows a block diagram of a base station in a mobile communication system of the invention,

Figure 4 shows a block diagram of a mobile station of the invention.

Detailed description of the invention

Time division radio systems, such as TETRA, employ a plurality of time slots in one frame in order to serve several radio units on the same radio frequency. In the arrangement of the invention, at least one time slot on each radio frequency is allocated, when necessary, as a control channel for serving all the radio units using the radio frequency in question.

A radio unit according to the first embodiment of the invention can listen to at least a traffic time slot and a control channel time slot during the same frame.

In the arrangement of the invention, information on which TETRA systems and base stations utilize the arrangement of the invention either call-specifically or permanently can be programmed into the radio units. The arrangement of the invention also allows the necessary information on an extended associated control channel to be transferred by signalling on the radio path from the base station to mobile stations, which makes the shared use with conventional radios more flexible.

Figure 1 illustrates the frame format in a TETRA mobile communication system. According to the TETRA protocol, the uplink frequency, i.e. the contra-directional frequency, or the direction from a mobile station to the base station (MS - 300, Figure 3), is delayed on system channels by two time slots in relation

to the downlink frequency, i.e. the codirectional frequency, or the direction from the base station to a mobile station (300 → MS, Figure 3). The system comprises main radio frequencies with a main signalling channel, and optionally other signalling channels and traffic channels. The present invention relates particularly to traffic channel radio frequencies, which are conventionally used as traffic channels, but the invention may also be applied on the main radio frequency.

In the frame format of the TETRA radio system, one hyperframe contains 60 multiframes, each of which contains 18 TDMA frames. The eighteenth frame of the multiframe is a control frame. Each TDMA frame is divided into four time slots 101-104. According to the invention, e.g. time slot 102 is allocated as a signalling channel, and time slots 101, 103 and 104 are allocated as traffic channels. In the figure, the multiframes are numbered from 1 to 60, the frames from 1 to 18, and the time slots from 1 to 4.

Figure 2A shows a channel allocation message according to an embodiment of the invention to be transmitted to a mobile station. According to this embodiment of the invention, the base station transmits to the mobile station a channel allocation message comprising the fields shown in Figure 2A: allocation type 2A1 and bit map 2A2. In the solution of the invention, the allocation type indicates, for instance, whether the channel to be allocated is a signalling (channel) time slot or a traffic (channel) time slot, and also the order of these fields. The bit map 2A2 shown in Figure 2A indicates those time slots of the frame which have been allocated for use according to the allocation type. The allocation of a certain time slot can be represented in the bit map in question, for example, by "1". For

instance, in a system where each TDMA frame comprises four time slots, bit map "1010" denotes that the first time slot, represented by "1", is allocated for signalling, while the third time slot, also represented by "1", is allocated for traffic, e.g. speech. In the second example, bit map "0111" denotes that time slot 2 is used for signalling, while time slots 3 and 4 together are used for traffic, e.g. for high-rate data. If only a signalling time slot is to be allocated, bit map "1000", for example, defines time slot 1 as the signalling time slot, whereas the other time slots are not in use.

If only a traffic time slot/time slots is/are to be allocated in such an arrangement, it is possible to provide for this purpose a second allocation type, which indicates that the time slots to be allocated are used merely as traffic channels.

Figure 2B shows a channel allocation message according to another embodiment of the invention to be sent to a mobile station. According to this embodiment, at least the signalling time slot and the traffic time slot/time slots are indicated separately as shown in Figure 2B. Depending on the manner in which the message has been encoded, some of the fields in the traffic time slots may be missing from the actual message. In Figure 2B, the first field 2B1 contains the number of the desired signalling time slot. Field 2B2 contains the number of the first traffic time slot, and fields 2B3 and 2B4 contain the numbers of the second and third traffic time slots, respectively. In the case of Figure 2B, the time slots are numbered from "1", for example, whereby "0" denotes that no time slot has been allocated to the function in question. The message "2, 3, 4", for example, denotes that time slot 2 is assigned for signalling, and time slots 3 and 4 are assigned for

traffic.

Figure 3 illustrates the structure of a base station according to the invention. A base station may comprise either one channel or a plurality of channels. The base station of the invention comprises a plurality of radio channels, which are different radio frequencies. A radio channel or frequency is time divisional, whereby one radio frequency may have several calls or signalling connections in the different time slots of the frequency in question. The base station 300 communicates with mobile stations MS of the mobile communication system on a radio frequency which is divided into TDMA frames, which are further divided into time slots, of which at least one can be allocated as a traffic channel of one or more mobile stations.

Each radio channel is connected to a transceiver unit TX/RX 301 and a controller 302. The antenna interface unit 303 comprises circuits for combining the radio channels and for connecting them to the antenna 304, from which the radio signal is transmitted to the radio path 308.

The base station is connected to a switching centre through an interface unit 305. The connection is typically digital, and a plurality of speech or signalling channels are multiplexed to the same connection.

In addition to other functions, the channel-specific controller 302 comprises means 307 for signalling with the subscriber stations. The controller 302 also transmits signalling messages to the subscriber stations, or subscribers, for instance when a call is being established or released.

The base station further comprises means 306 for transmitting to the mobile stations communicating with the base station information on the allocation of a time slot other than a traffic time slot in said TDMA

frame as a signalling time slot common to mobile stations communicating on said radio frequency, in response to which information said mobile stations communicating on said radio frequency start to use said time slot as their common signalling time slot in the signalling traffic between said base station and said mobile stations in such a way that said mobile stations can also communicate in one or more traffic time slots.

Figure 4 shows a block diagram of a communicating mobile station according to the invention. Figure 4 illustrates a typical communicating radio unit 400, i.e. a mobile telephone, mobile station or subscriber station used by a subscriber. The function of the transceiver (TX/RX) 401 is to tune to the radio channel used at a given moment. The transceiver 401 communicates with base stations or repeater stations on a radio frequency divided into TDMA frames, which are further divided into time slots, of which at least one can be allocated as a traffic channel of one or more mobile stations. The transceiver 401 is connected to an antenna 402, which is connected to the radio path RP. Radio frequencies in the range of from 60 to 1000 MHz (VHF and UHF ranges) are normally used, but it is also possible to use other frequencies. On the radio path RP, either analogue or digital modulation can be employed. A radio unit can tune to and communicate on the uplink and downlink frequencies.

A user interface 405 comprises electroacoustic transducers, typically a headphone 406 and a microphone 407, and optionally buttons for starting and ending a call and for dialling. Since in a trunked system, transmission over the radio path RP is advantageously unidirectional, the subscriber station usually also has a push-to-talk button, which must be depressed for the duration of the speech item. The push-to-talk button is

not shown in Figure 4.

The function of the controller 403 is to control the operation of the radio unit. The controller 403 is connected to a user interface 405, from which it receives signals for instance for starting and ending a call. The controller 403 may also give the user, via the user interface 405, acoustic or visual signals relating to the operation of the mobile phone and/or the mobile telephone system.

The controller 403 is connected to the transceiver TX/RX 401. The channel used by the transceiver is allocated by the controller 403, i.e. the transceiver 401 tunes to the channel, or radio frequency, allocated by the controller 403 and to an appropriate time slot. The transceiver 401 is also activated by the controller 403. The controller 403 receives and transmits signalling messages through the transceiver 401. A communicating radio unit, or mobile station 400, according to the invention can be used, for example, in a radio system comprising a radio network with at least one base station and subscriber stations and possibly one or more repeater stations that relay traffic between at least one base station and subscriber stations. In this case, the communicating mobile station comprises a memory means 411, a transceiver 401, and a controller 403 for controlling the operation of the mobile station.

The mobile station 400 according to the first embodiment of the invention comprises means 409 responsive to information on the allocation of a time slot other than a traffic time slot in said TDMA frame as a signalling time slot common to the mobile stations communicating on said radio frequency for commanding said mobile station to use said time slot with other mobile stations as a common signalling time slot in the signalling traffic between said base station and the

mobile stations in such a manner that said mobile stations can also communicate in one or more traffic time slots of said frame.

According to the second embodiment of the invention, in response to information on the allocation of a time slot other than a traffic time slot in said TDMA frame as a signalling time slot common to mobile stations communicating on said radio frequency, the mobile station is arranged to communicate only in one or more traffic time slots of said frames.

The drawings and the description relating thereto are intended merely to illustrate the inventive concept. In its details, the method, mobile communication system and mobile station of the invention can be modified within the scope of the appended claims. Although the invention has been described above mainly with reference to a TETRA radio telephone system, it may also be applied in other types of mobile communication systems.

Claims

1. A method for allocating time slots (101-104) in a mobile communication system comprising a base station (300) and mobile stations (MS), said base station communicating with said mobile stations on a radio frequency divided into TDMA frames (1-18), which are further divided into time slots (101-104), of which at least one (101, 103, 104) can be allocated as a traffic channel of one or more mobile stations, c h a r a c t e r i z e d in that the method comprises the steps of:

transmitting information from the base station (300) to a mobile station (MS) on the allocation of a time slot other than a traffic time slot (101, 103, 104) used by the mobile station as a signalling time slot (102) common to the mobile stations (MS) communicating on said radio frequency,

starting to use said time slot (102) as a signalling time slot common to the mobile stations (MS) communicating on said radio frequency in the signalling traffic between said base station (300) and said mobile stations in such a manner that the mobile stations can also communicate in one or more traffic time slots.

2. A method according to claim 1, c h a r a c - t e r i z e d in that the base station (300) further transmits to the mobile station (MS) information on which is/are the traffic time slot/slots (101, 103, 104) allocated to said mobile station in said frame.

3. A method according to claim 1 or 2, c h a r a c t e r i z e d in that the base station (300) further transmits to the mobile station (MS) information on that the allocation of the common signalling time slot (102) does not invalidate the previous allocation of traffic channels (101, 103, 104).

4. A method according to claim 1 or 2, c h a r a c t e r i z e d in that the base station (300) further transmits to the mobile station (MS) information on that the allocation of a traffic channel (101, 103, 104) to a certain mobile station or mobile stations, performed after the allocation of the common signalling time slot (102), does not invalidate the previous allocation of signalling channels.

5. A method according to claim 1 or 2, c h a r a c t e r i z e d in that the allocation of a time slot in said frame to said mobile station (MS) as a signalling time slot (102) is performed by including in a traffic channel allocation message information on the allocation of the signalling channel.

6. A method according to claim 1 or 2, c h a r a c t e r i z e d in that the allocation of a time slot in said frame to said mobile station as a signalling time slot is performed by always allocating as the signalling time slot (101) the first time slot in said frame.

7. A method according to claim 1 or 2, c h a r a c t e r i z e d in that the allocation of a time slot in said frame to said mobile station as a signalling time slot is performed by allocating as the signalling time slot the first time slot (101) indicated by a bit map (2A2).

8. A method according to claim 2 or 4, c h a r a c t e r i z e d in that the information on which time slot in said frame is the signalling time slot (102) common to the mobile stations (MS) communicating on said radio frequency is included in a system information message transmitted from the base station (300) to the mobile station.

9. A method according to claim 8, c h a r a c - t e r i z e d in that the information on which time

slot in said frame is the signalling time slot (102) common to the mobile stations (MS) communicating on said radio frequency is included in the bit map of the system information message transmitted from the base station (300) to the mobile station (MS).

10. A method according to any one of the preceding claims 1 to 9, c h a r a c t e r i z e d in that, having received information on the allocation of a time slot other than a traffic time slot (101-104) in said frame as a signalling time slot (102) common to the mobile stations communicating on said radio frequency, a mobile station which can communicate with the base station in only one or more traffic time slots of the frame communicates with the base station in only said traffic time slot or time slots.

11. A mobile communication system (Figure 3) comprising:

mobile stations (MS),

a base station (300) communicating with said mobile stations on a radio frequency divided into TDMA frames, which are further divided into time slots, of which at least one can be allocated as a traffic channel of one or more mobile stations, said base station comprising:

an antenna (303),

a transceiver (301),

a control unit (302), and

means (307) for signalling with the mobile stations,

c h a r a c t e r i z e d in that

the base station (300) further comprises means (306) for transmitting to the mobile stations (MS) communicating with the base station information on the allocation of a time slot other than a traffic time slot (101, 103, 104) in said TDMA frame as a signalling time

slot (102) common to mobile stations communicating on said radio frequency, in response to which information said mobile stations (MS) communicating on said radio frequency start to use said time slot as their common signalling time slot (102) in the signalling traffic between said base station (300) and said mobile stations in such a way that said mobile stations can also communicate in one or more traffic time slots (101, 103, 104).

12. A mobile station (Figure 4, 400; MS) comprising:

a transceiver (401) communicating with a base station on a radio frequency divided into TDMA frames (1-18), which are further divided into time slots (101-104), of which at least one can be allocated as a traffic channel of one or more mobile stations (MS),

c h a r a c t e r i z e d in that the mobile station comprises:

means (409) responsive to information on the allocation of a time slot other than a traffic time slot (101, 103, 104) in said TDMA frame as a signalling time slot (102) common to the mobile stations communicating on said radio frequency for commanding said mobile station (400) to use said time slot (102) with other mobile stations as a common signalling time slot in the signalling traffic between said base station (300) and the mobile stations in such a manner that said mobile stations can also communicate in one or more traffic time slots of said frame.

13. A mobile station (Figure 4, 400; MS) comprising:

a transceiver (401) communicating with a base station of a mobile communication system on a radio frequency divided into TDMA frames (1-18), which are further divided into time slots (101-104), of which at

least one can be allocated as a traffic channel of one or more mobile stations, said mobile station being capable of communicating with the base station in only one time slot of the frame,

c h a r a c t e r i z e d in that, in response to information on the allocation of a time slot other than a traffic time slot in said TDMA frame as a signalling time slot (102) common to mobile stations communicating on said radio frequency, the mobile station (400) is arranged to communicate only in one or more traffic time slots (101, 103, 104) of said frames.

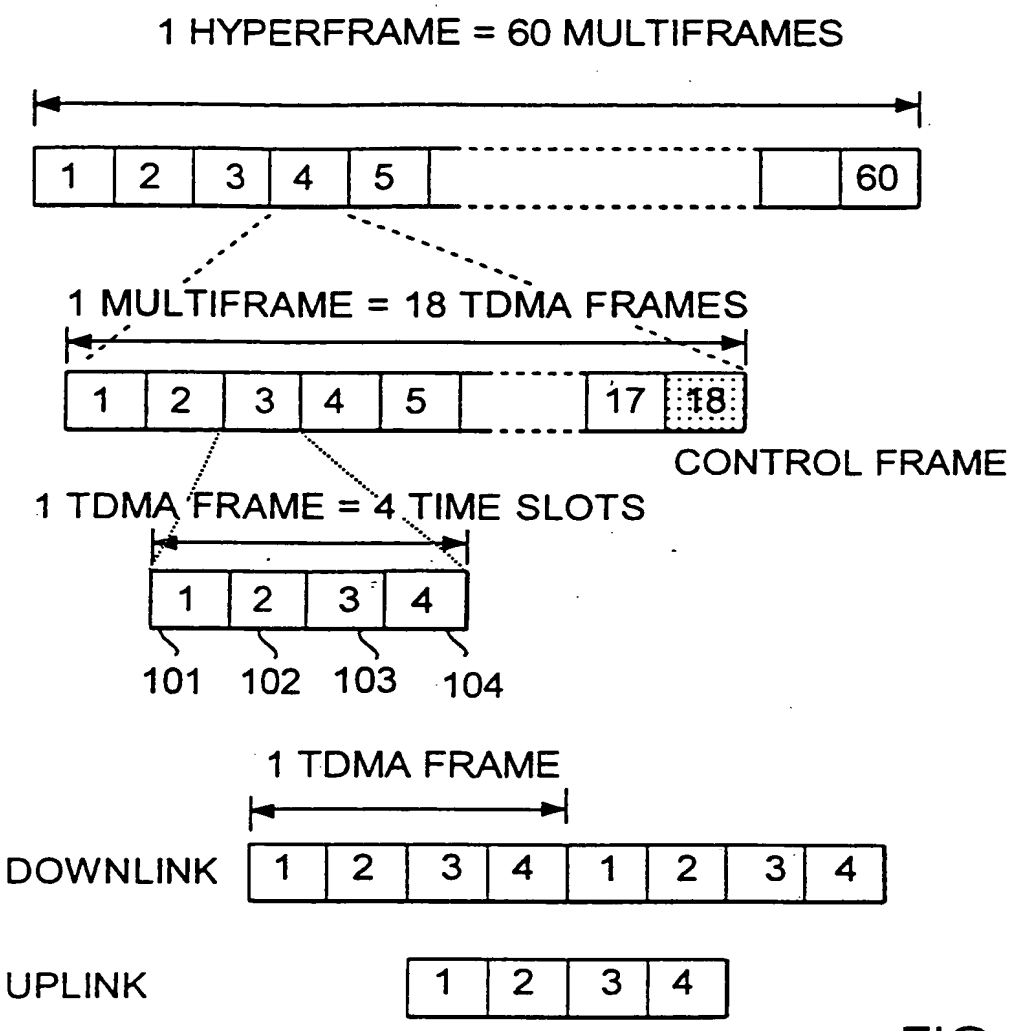


FIG. 1

FIG. 2A

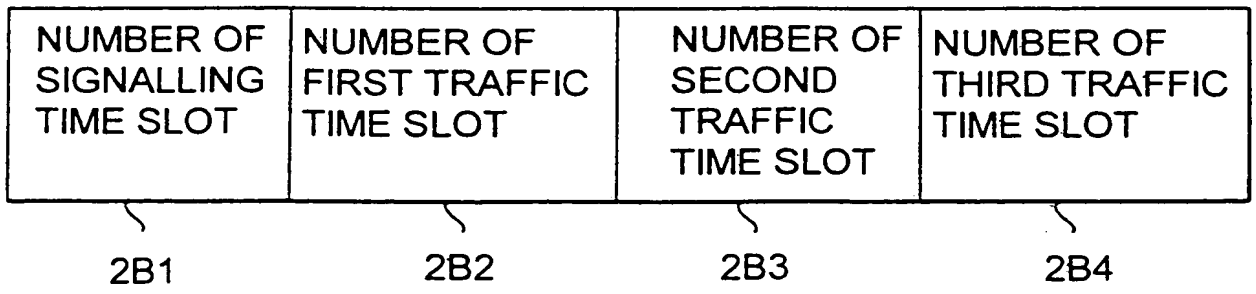


FIG. 2B

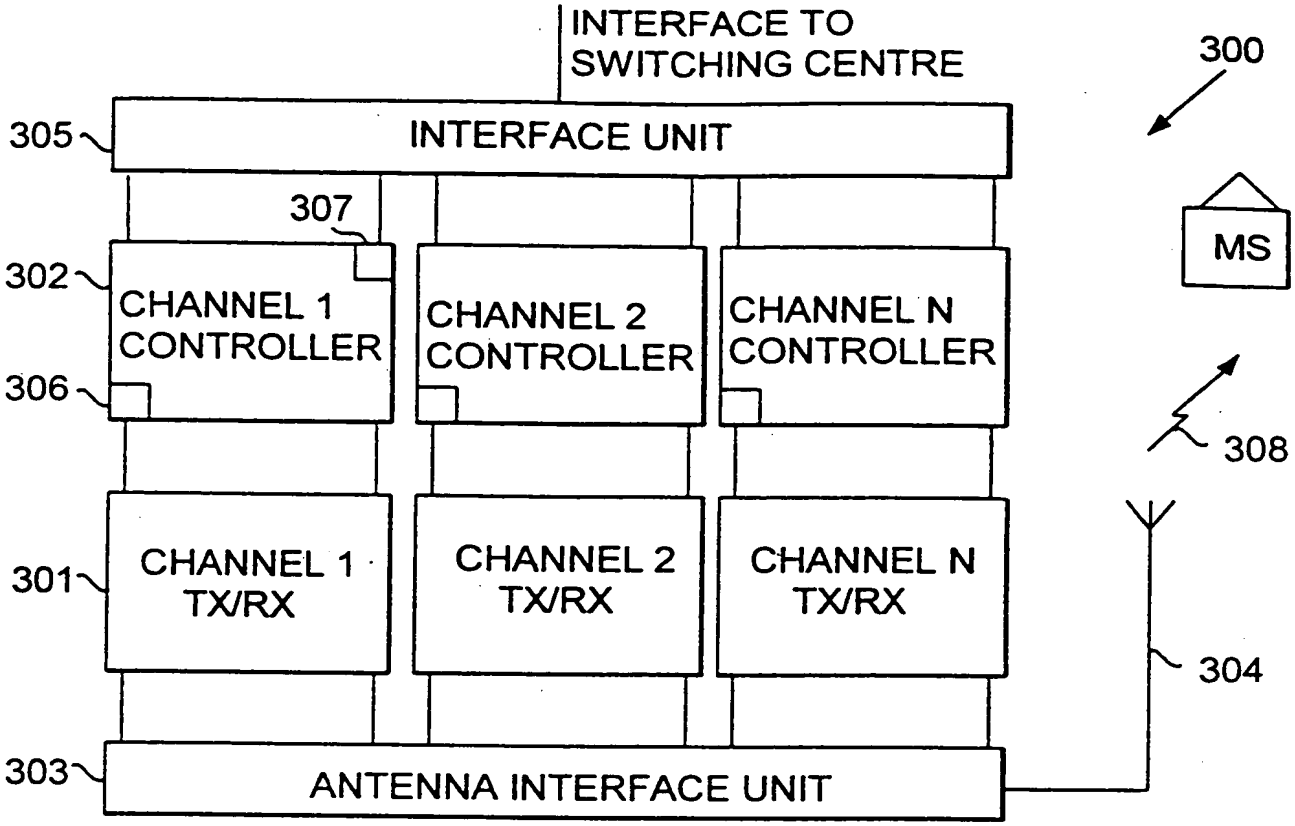
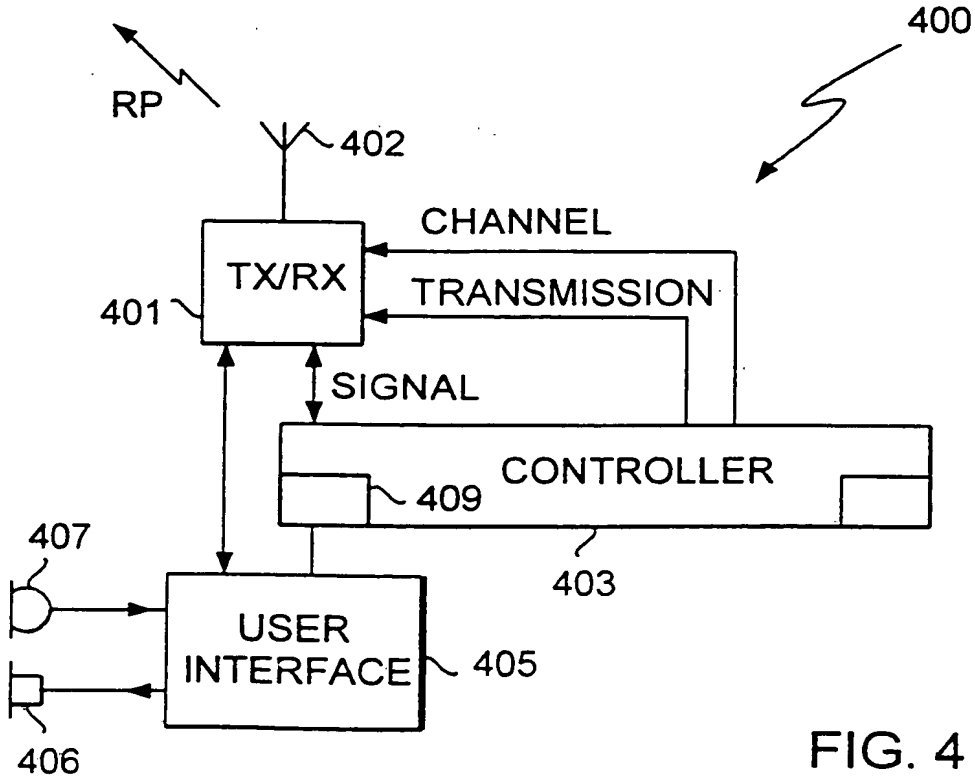

INTERFACE TO SWITCHING CENTRE
300
305
INTERFACE UNIT
307
302
CHANNEL 1 CONTROLLER
CHANNEL 2 CONTROLLER
CHANNEL N CONTROLLER
306
MS
308
301
CHANNEL 1 TX/RX
CHANNEL 2 TX/RX
CHANNEL N TX/RX
304
303
ANTENNA INTERFACE UNIT

FIG. 3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CONTROLLER
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USER INTERFACE
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FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 96/00088

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04B 7/26
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04B, H04J, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9310600 A1 (MOTOROLA, INC.), 27 May 1993 (27.05.93), page 6, line 32 - page 7, line 7, abstract -- --------	1-13

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 July 1996	16 -07- 1996
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Mikael Sollerhed Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/07/96

International application No.
PCT/FI 96/00088

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A1- 9310600	27/05/93	AU-B- 661512	27/07/95
		AU-A- 2760592	15/06/93
		BR-A- 9205514	26/04/94
		CA-A- 2099662	22/05/93
		EP-A,A- 0568659	10/11/93
		HU-A- 65233	02/05/94
		JP-T- 6504894	02/06/94
		PL-A- 300132	18/04/94
		US-A- 5442809	15/08/95